

What is claimed is:

1. A magnetic recording medium based on a perpendicular magnetic recording system, comprising:

a substrate which is formed of a non-magnetic material;

a soft magnetic back layer which is formed of a soft magnetic material and which is formed on the substrate;

an underlayer which is formed on the soft magnetic back layer; and

a recording layer which is formed of an alloy magnetic material mainly composed of CoPtCr and which is formed on the underlayer, the alloy magnetic material containing an oxide, wherein:

the recording layer includes two or more magnetic layers having different oxide contents, and a magnetic layer, which is included in the two or more magnetic layers and which is provided on a side nearest to the underlayer, has the highest oxide content in the recording layer.

2. The magnetic recording medium according to claim 1, wherein the two or more magnetic layers are stacked in such an order that those having higher oxide contents are disposed on a side nearer to the underlayer.

3. The magnetic recording medium according to claim 1, wherein the recording layer is provided in contact with

the underlayer.

4. The magnetic recording medium according to claim 1, wherein the oxide contents of the two or more magnetic layers are 5 to 20 mol %, respectively.

5. The magnetic recording medium according to claim 4, wherein the recording layer includes a first recording layer and a second recording layer, the first recording layer is arranged on a side of the underlayer, and the following relationship is established between an oxide content A1 in the first recording layer and an oxide content A2 in the second recording layer:

$$5 \text{ mol } \% \leq A2 < 12 \text{ mol } \% \leq A1 \leq 20 \text{ mol } \%$$

6. The magnetic recording medium according to claim 1, wherein the oxide contained in the recording layer is an Si oxide.

7. The magnetic recording medium according to claim 1, wherein the recording layer has a thickness of 8 to 20 nm.

8. A method for producing a magnetic recording medium, comprising the steps of:

forming a soft magnetic back layer on a substrate;

forming an underlayer on the soft magnetic back layer;

and

forming a recording layer on the underlayer with an alloy magnetic material which is mainly composed of CoPtCr and contains an oxide, wherein:

the step of forming the recording layer includes forming the recording layer by two or more magnetic layers having different oxide contents, and the recording layer is formed so that a magnetic layer, which is included in the two or more magnetic layers and which is formed on a side nearest to the underlayer, has the highest oxide content in the recording layer.

9. The method for producing the magnetic recording medium according to claim 8, wherein the two or more magnetic layers are stacked in the step of forming the recording layer in such an order that those having higher oxide contents are disposed on a side nearer to the underlayer.

10. The method for producing the magnetic recording medium according to claim 8, wherein the recording layer is formed by a sputtering method in the step of forming the recording layer.

11. The method for producing the magnetic recording medium according to claim 10, wherein the two or more magnetic layers having the different oxide contents are

formed by an RF sputtering method and a DC sputtering method with sputtering targets having an identical composition in the step of forming the recording layer.

12. The method for producing the magnetic recording medium according to claim 11, wherein the recording layer is formed by stacking a first recording layer and a second recording layer in this order on the underlayer by the sputtering method in the step of forming the recording layer, and wherein the sputtering targets having the identical composition are used to form the first recording layer by the RF sputtering method and form the second recording layer by the DC sputtering method.

13. A magnetic recording apparatus for recording and reproducing information on a magnetic recording medium, comprising the magnetic recording medium as defined in claim 1, a magnetic head which forms a magnetic circuit in cooperation with the recording layer and the soft magnetic back layer of the magnetic recording medium when the information is recorded on the magnetic recording medium, and a drive unit which drives the magnetic head relative to the magnetic recording medium.